

From Traditional to Clean Energy: Insights from the German *Energiewende*

Dr Annegret Groebel, Head of Department International Relations/Postal Regulation

Club des Régulateurs – Climate risks and regulation, 2nd Roundtable: *CRITICAL NETWORK INFRASTRUCTURES* Paris – Université Paris-Dauphine, 17 April 2019



www.bundesnetzagentur.de

Agenda



- Germany's Energy and Climate Targets
- The German Energy Transition 2011
 - Recap of the German *Energiewende* decisions
 - Impacts of the German *Energiewende*
- Solutions: Reforms 2016 (amendments to the 2011 energy legislation)
 - Grid Expansion Acceleration Act
 - Renewables growth and reform of the Renewable Energy Act in Germany
 - Amendments to the Energy Industry Act: the Electricity Market Design Act (EOM 2.0)
- State of play 2018/2019: where are we?
- Challenges and new tasks for the regulator
- Changing role of the regulator
- Conclusions and lessons learnt



The German government has set ambitious climate targets in the "Energy Concept 2050" (publ. 2010)

	2020	2030	2040	2050
Reduction of greenhouse gas emissions (cf.1990)	40%	55%	70%	80-95%
Share of Renewable Energies in total final energy consumption	18%	30%	45%	60%
Share of Renewable Energies in power consumption	35%	50%	65%	80%
Reduction of primary energy consumption (cf. 2008)	20%			50%

Climate protection as Germany's priority target

The Federal Government's Energy Concept (2010)





Targets by 2050:

- Decrease of greenhouse gas emissions by 80% in comparison to 1990
- Reduction of electricity consumption by 25% as compared to 2008
- Reduction of primary energy consumption by 50% in comparison 2008

Government targets for renewable electricity



- RES expansion corridor 40-45% (2025) 50-60% (2035) - Offshore wind 6.5 GW (2020) 15 GW (2030) - Volume control PV + 2.5 GW/a Onshore wind + 2.5 GW/a Biomass + 0.1 GW/a

wind power

2016 Cabinet resolution

- RES corridors confirmation but steadying it and more cost-efficient

- Cap for expansion of wind in areas with network "bottlenecks"

- Safeguard prod. mix

2018: new target: 65% RES by 2030



	2013	2025
Peak load	82,8 GW	84 GW
Net consumption	543,6 TWh	544 TWh
Conventional gen. cap.	101,1 GW	77,3
including storages	6,4 GW	8,6 GW
Renewable gen. capac.	81,1 GW	141,4 GW
including		
Onshore wind	33,8 GW	63,8 GW
OffShore wind	0,5 GW	10,5 GW
Photovoltaic	36,3 GW	54,9 GW
Interconnector capacity	from Ger. 29 GW	to Ger. 31,3 GW

¥<u>≬</u> 📞 🖂 🙀

- Seven energy transition targets:
- 40 45 per cent share of renewables to be reached in power consumption by 2025
- 65 per cent share of renewables to be reached in power consumption by 2030
- 2022: Year when the remaining nuclear power plants are to shut down
- 2038: Year when coal will be exited
- 40 per cent amount by which greenhouse gas emissions are to be reduced by 2020 (from 1990 levels)
- 55 per cent amount by which greenhouse gas emissions are to be reduced by 2030 (from 1990 levels)
- 50 planned reduction in our primary energy consumption by 2050 compared to 2008



Gross electricity production in Germany 2017*



2018: 35% RES growing faster than planned, but grid expansion is lagging behind and more GHG emissions due to an increased use of coal

Source: BMWI

- Germany's GHG emissions increased after the decision to shut down nuclear due to the use of more coal in the energy mix (so-called "merit order effect")
- On 26 January 2019 the Commission for Growth, Structural Change and Employment published its report suggesting that Germany is going to exit coal by 2038
- Until 2022 12.6 GW will be closed; Until 2030 a further 13.0 GW will be closed; Until 2038 the remaining 17.0 GW will be shut down.
- On 5th April 2019 the Government followed the proposal of the Commission to support the structural change in the coal regions with 40 bn. €
- On 8th April 2019 the Minister of Economic Affairs informed the EU Member States of Germany's decision to exit coal by 2038

Decision to exit coal by 2038 (2)



Kohleausstieg

Der Stufenplan bis zum Ausstieg

$\langle \rangle \rangle \langle \ast \rangle$

Nettoleistung der Kohlekraftwerke in Gigawatt (GW)





Energiewirtschaftsgesetz (EnWG of 7 July 2005)

- Goals: Secure, reasonably priced, consumer-friendly, efficient and environmental-friendly energy supply (section 1)
- Goal of energy regulation = more competition upstream and downstream (for generators, wholesale energy traders, energy suppliers [retail level])
- Energy regulation means ex-ante regulation of TSOs and DSOs by BNetzA and LandesRBs (PUCs)
- Grids are necessary for energy suppliers and producers
- One TSO/DSO per grid area = natural monopoly = regulation ensures that TSOs/DSOs do not abuse dominant position to provide discriminatory access to the grid at excessive prices
- Regulatory instruments:
 - Determine grid tariffs ex-ante
 - Ensure non discriminatory third party grid access to suppliers and consumers
 - Standardise ernergy supply
 - Improve conditions for grid connections of generating capacity



NABEG (from 28 July 2011) Not a regulatory competence!

- **NABEG:** Grid Expansion Acceleration Act
- Increase of renewables (wind and solar energy) requires grid adjustment
- Electricity grids must transport more RES
- Grids must be reinforced and expanded
- BNetzA must ensure rapid and efficient grid expansion and grid reinforcement
- How?
- TSOs (<u>50Hertz Transmission GmbH</u>, <u>Amprion GmbH</u>, <u>TenneT TSO</u> <u>GmbH</u> and <u>Transnet BW GmbH</u>) plan and manage transmission grids.
- If new lines are necessary, TSOs prepare a plan setting out all effective measures to optimize, reinforce and develop the network
- BNetzA approves the grid expansion after evaluation of the necessity



- Following the Fukushima catastrophe in 2011, the orientations set in 2010 have been complemented by an accelerated nuclear generation exit (previously foreseen for 2036)
- Moratorium imposed by the Government on the 8 oldest nuclear power plants immediately after the Fukushima catastrophe rendered permanent

- Shutdown of the remaining nine nuclear power plants by 2022
- BNetzA assessing generation adequacy and network development requirements

"Energiewende": Changes in the German energy mix (2)



Energy transition: path towards 2030



Large amount of volatile RES needs to be integrated – both into the grid and the market

Changes in the energy mix – Grid implications

Renewable energy sited mostly in <u>Northern</u> Germany (esp. wind) **Conventional and** nuclear generation sited mostly in Southern and Western Germany, as well as most of (industrial) load

The Energiewende – Key Messages

- No change of direction the "Energiewende" is the project of the Government who committed in the coalition agreement 2013/2017 to make the "Energiewende" a success story, but adjustments are needed
- Synchronization of the grid expansion with the RES growth needed in order to integrate renewables into the grid, grid expansion lagging behind
- Speed up grid expansion, in particular build 3 new major HVDC transmission lines from North to South, planning and permitting by BNetzA to bring RES from the North to the load centres in the South
- Reform of the Renewable Energy Act for a more cost-effective and more targeted renewables growth in force since 1 August 2014 to stop/reduce *"produce-and-forget"* mentality with a market-based approach; cabinet resolution 8 June 2016: corridors confirmed, but more cost-efficient growth
- Generation: conventional and renewable energy must be better balanced to ensure sufficient capacity is made available where and when needed, i.e. increase flexibility and find an appropriate market design: EOM 2.0 (Draft *Electricity Market Design Act* prop. on 4th Nov. 2015), adopted 8 July 2016
- Smart markets and smart regulation, i.e. make distribution grids smarter and foster flexible demand side response (DSR) to increase flexibility
- **Energy efficiency** increased, but more to do
- Conclusion: let's turn the big challenges of moving towards a low-carbon economy into chances by moving on jointly towards a more market-based approach, i.e. a smart market design providing proper price signals

- Important: Germany has no generation adequacy or SoS problem (still overcapacity of conventional power plants), only regional imbalances (between the North and the South of Germany), Germany is net exporter
- Question arising regarding the need of a capacity mechanism (CRM) answered with the Draft Electricity Market Design Act presented in Sept. 2015: No, for the reason mentioned above there is **no need for a CRM**
- (Draft) Law foresees an Energy Only Market EOM 2.0 relying on proper price signals: market based approach (as also preferred by the European Commission that foresees CRM only as second best option because of the cross-border effects (cons. July 2015); adopted in parliament on 8 July 2016
- Allowing price signals to work reacts to the need for more flexibility as in an environment that is increasingly volatile a "command and control" is no longer working, change can only be managed with a market based approach and will with some further measures of the 2016 reform of the Renewable Energy Act also ensure market integration of RES producers
- Changing roles for TSOs and above all for DSOs as they become energy service providers in a smart market (smart grids and smart meter roll out)

"Energiewende" in Germany:

- Already high achievements regarding competition and SoS, but more difficult than expected, in particular public acceptance + CO₂
- Therefore, the 2011 energy transition laws required amendments: White Book of the Ministry (BMWi), 2015: Electricity Market 2.0

Main Amendments (as adopted on 8 July 2016):

- Energy Industry Act (Energiewirtschaftsgesetz, EnWG): strengthening market mechanisms while also introducing instruments to ensure security of supply with the EOM 2.0 Act
- Incentive Regulation (Anreizregulierungsverordnung, ARegV): Switch from revenue caps to cost-of-service regulation for capital costs of DSOs (strong lobbying)
- Renewable Energy Act (Erneuerbare-Energien-Gesetz, EEG): further integrating RES into the energy market (more *tendering*) and more cost efficient growth corridors of RES (targets)
- Act on Digitisation of the Energy Transition: Smart Meter as key elements of the future electricity market: promote the use of digital technologies to enable DSR and "prosumers"

Reform of the Renewable Energy Act 2016

Direction of travel: LEVEL OF SUPPORT WILL INCREASINGLY BE DETERMINED TRHOUGH COMPETITIVE BIDDING PROCEDURES

- Pilot tendering procedure for ground-mounted PV lasted until 2017 (third round in 2015).
- Reform of Renewable Energy Act ("EEG 2017") towards more tendering, also for wind energy
- Major revision of legal framework 2016 to introduce tendering processes for wind onshore, wind offshore, PV rooftop panels (with de minimis threshold).
- Strike price significantly lower compared to administratively set tariff in first rounds
- For other RES technologies such as biomass, geothermal and hydropower, the reference support values will continue to be determined through an administrative procedure (reason: no competitive setting)
- Regional cooperation with neighboring Member States are under discussion, one cross border tendering with Denmark run already

Overview of German energy market legislation and regulation (incl. Energy transition laws) - 2016





Overview of German energy market legislation and regulation (incl. Energy transition laws) - 2019

₩<u>0</u> 📞 🖂 딡





- RES grew faster than expected (in 2017 already more than one third of gross electricity production stems from RES), but high costs for subsidies led to an increase in the RES surcharge (cov. diff. betw. RES support – wholesale price)
- Grid expansion is lagging behind causing congestion, thus costs increase: costs for redispatch and feed-in management increase to manage grid congestion, (faster) investment for grid expansion increased network charges (inspite of incentive regulation with a revenue cap)
- Mismatch between RES growth and grid expansion requires action to synchronise both and manage costs
- Reform of the Renewable Energy Act 2016: change towards **tendering**: successful, strike price of RES auctions run by BNetzA in 2017 significantly lower than administratively set price (shows that RES are competitive)
- Regulation of Grid Expansion Areas, i.e. allow RES growth only where the grid is ready (already or soon) 22

Grid Expansion: Scenario 2019-2030

 The new Scenario for the Network Development Plan 2019-2030 takes the new target of a share of 65% RES in 2030 already into account as well as the phase-out of coal



Installierte Erzeugungsleistung [GW]							
Installierte Leistung [GW]	Referenz 2017	Szenario A 2030	Szenario B 2030	Szenario C 2030			
Braunkohle	21.2	9.4	9.3	9			
Steinkohle	25	13.5	9.8	8.1			
Erdgas	29.6	32.8	35.2	33.4			
Öl	4.4	1.3	1.2	0.9			
Pumpspeicher	9.5	11.6	11.6	11.6			
sonstige <u>konv</u> . Erzeugung	4.3	4.1	4.1	4.1			
Wind Onshore	50.5	74.3	81.5	85.5			
Wind Offshore	5.4	20	17	17			
Photovoltaik	42.4	72.9	91.3	104.5			
Biomasse	7.6	6	6	6			
Wasserkraft	5.6	5.6	5.6	5.6			
Nettostrom- verbrauch *	530.1	512.3	543.9	576.5			
EE-Anteil am Bruttostromvbr.	32	64.7	64.8	65.1			

* inkl. VNB Netzverlusten

Grid expansion needs 2017-2030



- 96 von 165 measures could be confirmed
- = ca. 6.350 km expansion
 + restructuring (adding
 950 km compared to the
 current Federal network
 requirement plan BBP)
- All measures of the BBP were confirmed, in particular 3 HV DC transm. lines from north to south, i.e. the distance between the generation and the load centres is larger

State of Art (2018) Network development





5900 km total acc. to the Federal Requirement Plan Act, of which 3050 km are classified as "reinforcement"

600 km are approved, 150 km are realised

Abbildung 31: Stand der Ausbauvorhaben nach dem Bundesbedarfsplangesetz (BBPIG); Stand: 3. Quartal 2018



- Increasing share of RES to reach climate targets is inevitable, but creates new challenges both for the grid (new dimensioning/restructuring due to decentralised / distant generation) and RES grid and market integration
- More interaction between the generation level and the grid requires a more **flexible** energy system
- More flexibility requires adaptive/dynamic regulation using a market-based approach to reflect the closer interaction between the generation level and the grid as well as the supply/retail side (DSR, prosumers etc.)
- Define roles of all players and rules **ex-ante** to ensure a level playing field so that market mechanisms can work and send the efficient price signal (**EOM**) so that the right mixture of technologies and flexibility solutions can develop instead of acting ex-post as "repair regulation (over-steering)"
- Conclusion: "smart" regulatory oversight needed with a market-based holistic customer-centric approach



Regulatory challenges

- The variety of the grid system operators in Germany is challenging for a regulatory system which is aimed to be tailor-made for all.
- Grid expansion is and will remain essential to integrate an increasing share of renewables into the grid to ensure a successful *Energiewende* including meeting the climate targets
- The energy transition involves large investments in transmission and distribution systems – even with the amended Renewable Energy Act.
- Ensure via incentive regulation that investments are made at efficient costs while ensuring investments can be made quickly and have an appropriate rate of return on equity
- Security of Supply (SoS) in Germany is of high importance and requires a sufficient backup (capacity reserve).
- The cost of grid and supply security measures will continue to increase, but these costs of security of supply and network expansion must be limited as far as possible.



Regulatory targets and tasks of the regulator

- Innovation and technological openness is important at all levels of the energy system.
- The energy transition (*"Energiewende*") needs a modern economic regulation of the grids to ensure adequate investments in the transmission and distribution systems in the long run to cope with an increasing share of RES in order to reach the climate targets!
- This comes at a price, but it should still be done in an efficient manner, thus BNetzA uses the 3 instruments:
 - incentive regulation (prevent over-/underinvestment),
 - determination of the rate of return on equity (prevent over-capitalizati.) and

 its role in planning/permitting of the HV electricity grid to ensure they best serve the purpose and fit with each other

 Liberalization is a high achievement. Prior accomplishments in liberalization must not be compromised. Measures to restrict competition should be avoided: market based approach!

Bundesnetzagentur considers itself a promoter of and a contributor to the energy transition and has a broader role!

BNetzA's tasks in energy regulation





- ₩<u>0</u> 📞 💌 💂
- Given the changes of the energy system needed to integrate RES into the grid and markets, the regulator has more responsibilities than in the past
- Not only the traditional regulation of the grid (access and rates regulation) as a natural monopoly, but
- More and more tasks regarding the market integration of RES, e.g. tendering of RES (solar, wind tenders) and ensuring a more flexible system
- Speeding up the grid expansion to ensure the grid structure and capacity is in line with the growth of RES (new tasks of planning and permitting were given to BNetzA in 2011) and confirmation of the network development plan submitted by the 4 electricity TSOs
- Cooperation with all national regulators of EU Member States and observers in the European bodies (ACER) to ensure the development of the internal energy market in Europe is promoted and no cross-border barriers hamper energy trading and cooperation to ensure SoS
- Ensuring secure, efficient and sustainable (environmental-friendly) energy supply at reasonable prices to consumers: moving towards a customer-centric model (with "active" consumers) with smart regulation
- Ensure a move towards clean energy to meet the climate targets

Smart market and smart regulation





Conclusions (1)



- Stable and **predictable** regulatory framework is key to ensure investors' confidence and avoid disruption
- Renewables require a more flexible energy system, which is best achieved by a more market-based approach with the participation of <u>all</u> players that must adapt their business models to this transformed energy system and react to new incentives
- Keep hands-off, i.e. let the market work and abstain from interventions distorting the price signals as well as the incentives to invest in new infrastructure
- EOM 2.0 is embarking on this approach, at the same time the RES Act is reformed too to ensure a more synchronised expansion of the grid and the renewables: interplay of both is key
- Develop the EU Internal Energy Market to realize cross-border benefits (market coupling, NC) and overall security of supply: CEP
- Develop smart markets providing the right price signals to cope with increased complexity of the energy system based on competition developing towards a customer-centric model
- Use smart regulation to transform the energy system

Conclusions (2)



- Renewables require a more flexible energy system, which is best achieved by a more market-based approach as achieved with the reform of the RES Act: more tendering!
- Define roles of all players and rules **ex-ante** to ensure a level playing field so that market mechanisms can work and send the efficient price signal (EOM)
- In the short run no capacity mechanism is needed, there are only regional imbalances but overall overcapacities, thus the security of supply is not in danger (no market failure), development unclear for the middle and long term
- The short term issues can be dealt with by contracting reserve capacity and blocking retiring of power plants considered system-relevant
- Germany's Energiewende is a test bed for t. transformation of the energy system enabling the integration of increasing shares of RES to meet the climate targets and hopefully lessons can be learnt to avoid our mistakes!



Thank You for your attention!

Back-Up



Gross electricity production in Germany 2017*



What is still to come for the Clean Energy for all Europeans package?



- Clean Energy Package (CEP) proposed by Commission on 30 Nov. 2016
- Legislative process in the European Parliament and the Council
- Preparation of the integrated national energy and climate plans
- Implementation of the **enabling measures** to support the transition to a clean energy system

• Overview:

https://ec.europa.eu/energy/en/topics/energy-strategyand-energy-union/clean-energy-all-europeans Functioning retail markets, consumer empowerment, and "prosumers" DSR (flex.+ stability) Flexible energy system: EOM preferred – price signals, Capacity Mechan. only second best, i.e. no IEM distortion + open to XB participation

Security of Supply Risk Preparedness Regulation

Competition rules, State Aid rules, 2015 CM Sector Inq. Clean Energy f. All Europeans EMD, Recast, ACER-Regulation RES + Energy Efficiency Dir.: Fully integrated IEM and RES integration, energy effi.

More market-oriented RES support, nation. schemes open to XB participation

Internal Energy Market 3rd IEM Package 2009, XB trade, Market Coupling,

Network Codes/Guidelines

TEN-E Reg. 347/2013 (Proj. of Common Interest) Infrastructure Pack. 2013

- Renewables Energy Directive 82018/2001/EU)
- Energy Efficiency Directive (2018/2002/EU)
- Governance Regulation (EU No 2018/1999)
- Were published in thee OJ on 21 Dec. 2018 and entered into force on 24 Dec. 2018
- The political agreement on the ACER Regulation was reached on 11 Dec. 2018
- The political agreement on the Electricity Directive and the Electricity Regulation was reached on 18 Dec. 18
- Formal adoption planned for end of March 2019, and publication in the OJ, after that the 18 months transposition period for the Electricity Directive starts



- Consumers are in the centre of clean energy
- Active consumers can participate in the market and profit from cnsumer protection rules
- New limit for power plants subject of a Capacity Renumeration Mechanism
- Subsidies for generation cappacity with emissions of 550g CO2/kWh are gradually phased out
- New EMD as suggested EOM, CRM subject to justifications, the new EMD shall allow to integrate an increasing share of RES by allowing more flexibility
- It's necessary to increase the RES share and the electricifaction to realize CO2 neutrality by 2050

₩<u>0</u> 📞 🖂 🖳

- Electricity Regulation:
- Priority dispatch: list of exemptions for Member States with more than 50% RES
- Art. 13 Removal of congestion and definition of bidding zones: shall be based on long term structural congestions in the transmission networks and ENTSO-E report on structural congestions every 3 years
- Art. 14 Capacity calculation and congestion management: 70% (instead of 75% proposed) of interconnector capacity should be made available for cross-border trade
- Capapcity mechanism: only temporary measure and will be approved by the Commission no longer than 10 years
- Regional Coordination Centres (RCC): no binding powers



- Electricity Directive:
- Regulated retail prices: Member States that intervene for vulnearble and energy poverty customers must meet the reporting obligation of the Governance Regulation
- ACER Regulation:
- The majority rule remains 2/3 of BoR members
- BoR has more rights and can request amendments to the draft measures submitted by the Director
- ACER has new tasks with regard to NCs, RCCs and NEMOs
- DSO entity created (ENTSO-DSO)
- ACER can raise fees in case of not sufficient budget

Comparison of 2016 German legislation and EU CEP 🚻 📞 🖂 💆





- Key targets for 2030:
- At least 40% cuts in greenhouse gas emissions (from 1990 levels)
- At least 32% share for **renewable energy**
- At least 32.5% improvement in energy efficiency

Carbon neutrality by 2050

Amendments to the Gas Directive and US LNG imports to Europe



- On 8th Nov. 2017 the Commission proposed amendments to the Gas Directive, mainly an EU responsibility for third country gas pipelines
- Finally on 13th February 2019 the political agreement was reached that the EU is reponsible for the final decision on third country gas pipelines, but that the Member State where the line lands is responsible first for the proceeding
- Thus, e.g. for Nord Stream-II Germany (BNetzA) will be responsible for the proceeding
- On 8th March 2019, the EU Commission published that the LNG imports from the US to the EU increased by 181% from July 2018 to March 2019 as a result of the strategic agreement, thus the US imports now have a share of 12.6% of all EU imports, for Germany 2 LNG terminals are envisaged by the Minister of Economics
- However, there are 2 impediments: compared to other exporters the US LNG gas is still relatively expensive and an approval of the FERC is still needed for exports



Thank you for your attention

Dr. Annegret Groebel annegret.groebel@bnetza.de